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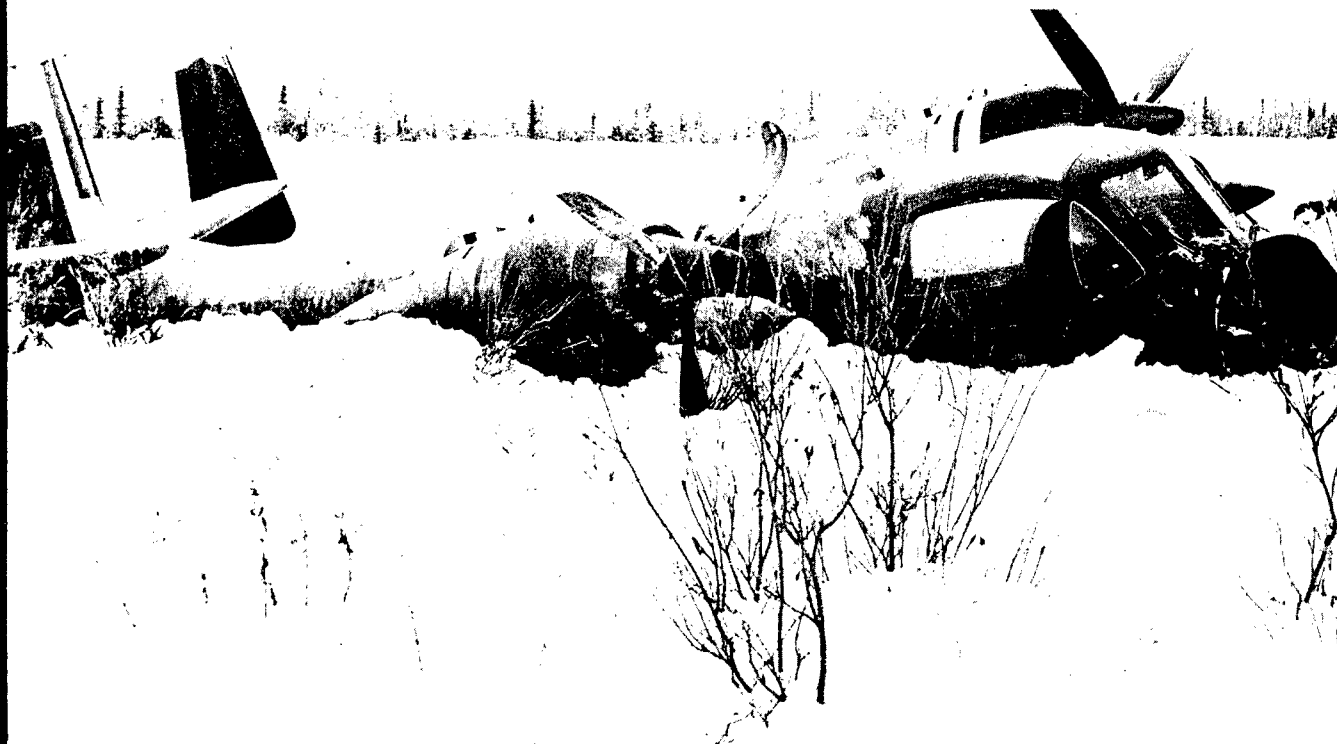
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OV-1



mishap experience report



OV-1 MISHAP EXPERIENCE REPORT

FY 1972 through FY 1974

by
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OV-1 MISHAP EXPERIENCE REPORT

FY 1972 THROUGH FY 1974

INTRODUCTION

This report was prepared to aid commanders, aviation safety officers, maintenance officers, aviators, and related aviation personnel in accident prevention and the preservation of combat resources through a review of past OV-1 mishaps and their cause factors. The term "mishap" includes accidents, incidents, forced landings, and precautionary landings as defined in paragraph 2-9, AR 385-40, dated 15 August 1972. Aircraft losses or damages which were the direct result of hostile action in RVN are not included. "Damaging mishaps" are those reported as major accidents, minor accidents, and incidents. "Nondamaging mishaps" are forced landings and precautionary landings.

SYNOPSIS

The OV-1 was involved in 376 mishaps during the period FY 72 through FY 74. There were 11 major accidents, 1 minor accident, 46 incidents, no forced landings, and 318 precautionary landings. Based on 98,615 total flying hours during this 3-year period, the accident rate was 12.17 per 100,000 flying hours. The OV-1 accident rate progressively increased from 9.62 in FY 72 (51,950 hours and 5 accidents) to 11.36 in FY 73 (26,412 hours and 3 accidents) to 19.75 in FY 74 (20,253 hours and 4 accidents). During this period the overall worldwide accident rate was progressively decreasing from 11.89 in FY 72 to 7.15 in FY 73 to 7.08 in FY 74. Nine occupants received fatal injuries and six received nonfatal injuries. Damage was incurred in 58 of the 376 mishaps, costing approximately \$13,584,696.

Three hundred and sixty-seven definite and 71 suspected cause factors were recorded for the 376 mishaps reported. These are shown in figure 1. For the 58 damaging mishaps, 70 definite and 36 suspected cause factors were recorded (figure 2). A brief comparison of figures 1 and 2 reveals that although a majority

of mishaps involved materiel cause factors, personnel cause factors were predominant in the damaging mishaps.

Instructor pilots were aboard during several damaging mishaps which involved personnel cause factors. This suggests that perhaps more critical instructor pilot selection is warranted. Other mishaps clearly indicate nonuse of checklists and improper emergency procedures or control techniques. One was a classic case of poor judgment. Generally, the high-cost mishaps resulted from a lack of professionalism among pilots and instructor pilots. Most of the damaging mishaps in which materiel cause factors were involved were incidents. These were primarily attributed to the landing gear, loss of fairings and hatches, and tip tanks separating from aircraft in flight.

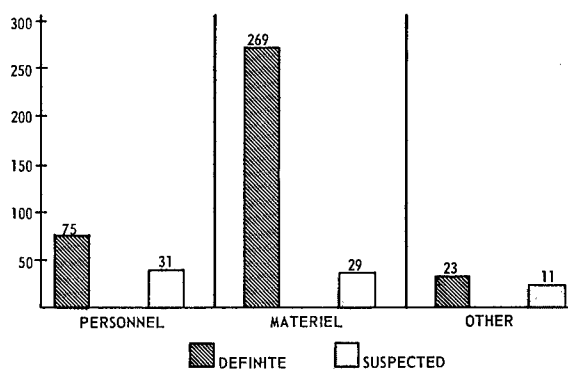


FIGURE 1.—Cause Factors for 376 Mishaps

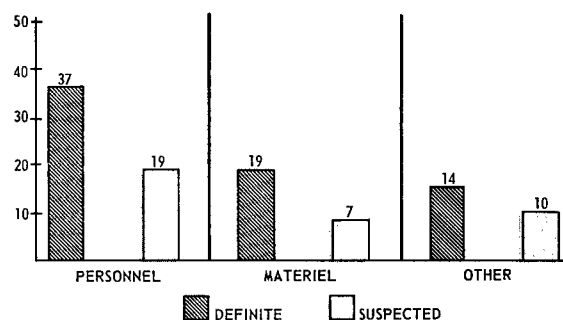


FIGURE 2.—Cause Factors for 58 Damaging Mishaps

CONCLUSIONS

Although materiel dominated the definite cause factors recorded for all mishaps (72%), personnel was recorded as the leading definite cause factor in damaging mishaps (53%). Twelve (21%) of the damaging mishaps accounted for \$13,436,402 (99%) of the damage and all of the injuries and fatalities. Materiel factors referenced in this report include failure of parts and components from all causes, i.e., prior over-stress, improper maintenance, etc.

More exacting standardization, especially in the area of emergency procedures, and increased command emphasis on the use of checklists, will serve to reduce the number and severity of mishaps resulting from personnel cause factors.

Immediate reporting of all materiel deficiencies through the Equipment Improvement Recommendation (EIR) program in accordance with TM 38-750 is the best method we have of reporting unsatisfactory equipment and influencing improvements and/or modifications when necessary. With improved materiel and components, materiel-related mishaps will decline.

DISCUSSION

Fifty-eight (15%) of the 376 mishaps accounted for all damage (\$13,584,696); 12 accidents (3%) resulted in damage totaling \$13,436,402 (99%); while 46 incidents (12%) accounted for the balance of \$148,294 (1%). The other 318 (85%) mishaps were precautionary landings. While they did not result in dollar losses they did result in numerous aborted missions and required innumerable unscheduled maintenance man-hours to correct. The 240 recorded system failures for FY 72-74 provide an insight into the materiel problem areas. The engine proved to be the biggest problem area with 77 failures recorded. The hydraulics system was next with 61 recorded failures, followed by the gear system with 36 failures. The fourth system of major concern was the electrical system with 29 recorded failures. These four systems should be given special attention during all scheduled maintenance as well as during flight. Other systems with a less frequent history of failure are instruments and propeller systems with ten recorded failures each; the fuel system and airframe with six and four failures respectively; avionics with three; the utility system with two; and the flight control

system and armament system with one recorded failure each.

All personnel cause-related mishaps are preventable and it should be the goal of all aviation personnel to eliminate such mishaps.

IP errors. One of the most glaring personnel cause related mishaps occurred when an instructor pilot (IP) placed the student pilot (SP) in an unusual attitude during a checkride while the SP's attention was diverted. The aircraft was in a dirty configuration. The IP then pulled the fire handle for the No. 1 engine and gave the aircraft back to the SP. The aircraft went into an uncontrollable spin and the IP made his first right decision—both IP and SP ejected. Two other mishaps occurred when aircraft were landed gear-up during training flights with an IP aboard.

Failure to use authorized procedures. The two gear-up accidents mentioned above are excellent examples of failure to use checklists or improper use of checklists. Numerous incidents occurred from failure to secure hatches and cowlings as prescribed in the operator's manual during preflight or before starting engines.

Maintaining insufficient clearance. Several cases of maintaining insufficient clearance occurred both in the air and on the ground. All the ground-handling mishaps would probably have been prevented had ground guides been employed. They were not used in any instance. Maintaining insufficient clearance was the suspected cause in one total loss accident in which two personnel were killed. Flying into trees at 180 knots plus can be catastrophic, but can be prevented by rigid SOP's supported by strong command and operational supervision.

Materiel malfunctions. Engines led all other systems in reported failures, mainly because of chip detector light illuminations. Some second and fourth stage disc failures have been reported but modernization of aircraft to delta model configuration and modification of the dash 701 engine by installation of a titanium rotor should alleviate this condition. The second highest system in failures was hydraulics. Failures were reported as leaking seals and ruptured or broken lines to the gear, flight controls, flaps, etc. Unfortunately, a failure anywhere in the system causes the entire hydraulic system to malfunction. Fortunately, the gear hydraulic

system is backed up with a comparatively fool-proof pneumatic emergency extension system. The seal in the main gear master cylinder should probably be considered the most critical from a damage standpoint. This particular seal is exposed to considerable heat during extended braking periods which may result in seal deterioration, which can induce a hydraulic fluid leak onto the hot brake disc and result in fire. Fire-resistant hydraulic fluid (MIL-H-83282) is presently under consideration and will reduce or eliminate this fire hazard if it is eventually adopted for use. Gear system malfunctions occurred primarily with the main gear and only occasionally with the nose gear. Malfunctions consisted mostly of faulty indicators, resulting in erroneous indications of gear position. Wiring of the gear indicator has also been identified as a problem area, resulting in no indication or an erroneous indication of the gear position. Both of the above potential malfunction/failure areas should be closely monitored during scheduled maintenance to reduce unnecessary precautionary landings. The fourth most frequent system to fail was the electrical system. The major contributors to electrical system failures were inverters, followed by starter generators. Although fourth in frequency of system failure, the electrical system was the leading system failure in magnitude of mishap or dollar loss, having been recorded as a definite cause factor in one major accident and as a suspected cause factor in a total loss. These two mishaps resulted in a damage total of \$3,091,606. The major accident was the result of a break in the wire leading to the No. 2 propeller reversing switch. This has been addressed by the United States Army Aviation Systems Command (USAAVSCOM) and this wire will be shown lengthened and rerouted

in future TM's. The total loss occurred as a result of suspected failure of both inverters and simultaneous loss of all flight instruments except the magnetic compass under instrument meteorological conditions. This also has been addressed by USAAVSCOM with an MWO to the OV-1D providing a d.c. powered standby attitude indicator that will still be available to the pilot in case of loss of both inverters and the a.c. instruments. Immediate and conscientious reporting of each materiel malfunction or failure as it occurs, through the EIR program as prescribed in TM 38-750, will assure improved quality of materiel and will increase systems reliability.

Ejections. There were six ejections during this 3-year period. Two ejectees received minor injuries and four received major injuries, primarily the result of compression fractures received during ejection. Installation of the improved MK-J5D ejection seat is scheduled to begin in early 1975. The improved seat will provide an improved capability (60 knots versus 100 knots in present seat) but will reduce the ballistic charge which should reduce the rate and severity of compression fractures considerably. Hopefully, performance envelope information will be provided with the improved seat that will better inform the user of the capabilities of the seat under various combinations of airspeed, attitude, and altitude. None of the nine occupants who received fatal injuries during this period ejected. The reasons are unknown and can only be speculated upon. The OV-1 was not designed to be crashworthy. Therefore, if conditions have reached the point where ability to regain control of the aircraft at a safe altitude is in doubt, ejection is the only alternative.

SELECTED ACCIDENT BRIEFS

ACCIDENT NO. 1-IP and pilot took off for a checkride and climbed to 7,500 feet. After entering the upper airwork area, IP had pilot do some unusual attitudes, including recovery from near vertical flight and inverted flight. Pilot went into series of power-on stalls in cruise configuration (clean), then with gear and flaps

extended (dirty) at approximately 10,000 feet msl. IP took control of aircraft and placed it in power-on "dirty" stall while pilot diverted his attention out the left window. Before relinquishing control of aircraft, IP pulled No. 1 engine fire handle, thus shutting the fuel off to No. 1 engine to practice an actual engine failure.

Since the fuel is shut off at the wing root, approximately 4 to 5 seconds are required before the engine actually quits. As pilot lowered nose, engine quit. Pilot then moved power lever of No. 2 engine to what he thought would produce 60 pounds of torque. Both aviators later commented that approximately 80 pounds of torque was developed by No. 2 engine. At that time, the aircraft rolled into a 30° left bank with a slight nose-down attitude. Pilot applied full right rudder and aileron, reducing the left bank to approximately 10°. IP took control and moved No. 2 engine power lever to flight idle while still applying right rudder and aileron. At this point, aircraft suddenly snapped to left, pitched down, and entered spin. IP then feathered propeller of No. 1 engine, retracted landing gear and speed brakes, and reduced flap setting from 45° to 15°. Noticing the extreme nose-down attitude, IP retracted remaining flaps while still maintaining right rudder and aileron. Aircraft then pitched up and continued spinning rapidly to left in near level attitude. The altimeter was indicating approximately 9,500 feet msl when the aircraft banked to the left approximately 45°. Aircraft then returned to level attitude. IP tried various control inputs during descent and, at approximately 7,500 feet, he told pilot to eject at 5,000 feet. At 5,000 feet the IP ejected and at approximately 4,500 feet the pilot ejected. Both ejections were successful.

This accident was caused by the IP placing the aircraft in a dangerous situation in that he induced an actual engine-out condition with the aircraft in a stall attitude with landing gear, flaps, and speed brakes extended. IP was not

knowledgeable of the proper spin recovery techniques for the OV-1 as outlined in TM 55-1510-204-10/4.

ACCIDENT NO. 2—Pilot was returning from proficiency flight and was approximately 6 miles southeast of the airport when he noted loss of power and illumination of cockpit warning lights. He immediately began a climb and then lost all feel of the stick. Aircraft banked to left and pilot safely ejected.

Pilot did not insure that sufficient fuel was on board to successfully complete the flight, violating AR 95-1. The fuel low warning system was determined to be inoperative. This was caused by dirty contact points in the control unit and prevented circuit completion to the caution light during low fuel conditions. The illuminated fuel boost pump caution light indicated there was no fuel being supplied by the pumps although both pumps were found operational.

Lack of supervisory attention was also a cause factor. Possible cause factors were:

- Inoperative fuel gauge.
- Inoperative right drop tank.
- Aircraft was placarded with "service main tank only."
- Insufficient specialization in maintenance to provide continuous high quality work.
- Inadequate quality assurance program.
- Authorized technician manning insufficient to insure a realistic standardization program.
- Authorized technician manning insufficient to provide and support a realistic operational training program.



ACCIDENT NO. 1



ACCIDENT NO. 4

- Unrealistic requirements in job descriptions of technicians.

- Insufficient supply of some repair parts, tools, and test equipment.

- No required inspection criterion for the low level fuel warning light system.

ACCIDENT NO. 3—Pilot discovered during preflight that engine oil samples were 7.5 hours overdue. Crew chief took engine oil samples at that time and pilot conducted thorough preflight. Pilot and observer then boarded aircraft. Immediately after aircraft left ground and just as pilot placed landing gear handle in up position, he heard an explosion and observer told him the No. 2 engine was on fire. Pilot could also see blue flames coming from engine. He shut down the No. 2 engine, manually feathered propeller, and discharged both fire bottles into right engine nacelle. He was reaching for the external stores jettison handle when aircraft went into right bank that full left aileron and rudder would not counteract. Pilot then initiated an ejection and aircraft continued rolling to right. Observer's ejection did not begin until the aircraft impacted and he was killed.

This accident was caused by failure of the right engine during takeoff. Takeoff at a speed below minimum safe single engine speed and failure to jettison external fuel tanks were contributing factors.

ACCIDENT NO. 4—During training flight, IP gave pilot simulated single engine on takeoff. Pilot established single engine flight, flew the pattern, and landed without difficulty. During

the next traffic pattern, IP initiated simulated single engine as pilot was turning base leg. Landing gear was retracted and single engine flight was established. When landing was assured pilot extended gear and made prelanding check. Pilot turned final and aircraft was landed gear up. Aircraft slid to stop on runway and IP and pilot exited.

The suspected cause of this accident is that the rated student pilot initiated gear retraction during the final moments before touchdown, and the IP failed to recognize this soon enough. A suspected contributing factor is that the student pilot had a significant marital problem which was unresolved at time of accident. This could have served as a distracting influence.

ACCIDENT NO. 5—Pilot and technical observer (TO) were on aerial photo mission. A pilot flying an OH-58 in the immediate area asked the OV-1 pilot to perform a low pass over an airfield. The OV-1 pilot replied that he would make the low pass after completing his photo mission. When his mission was completed, he received clearance from the airfield tower operator for the low pass. He was then seen by witnesses to depart his holding pattern, proceed onto an extended left base leg for a runway at approximately 500 feet agl, and then perform a very steep left turn of about 90° bank to final approach in which he overshot the extended centerline. He then climbed to approximately 800 feet agl. This was followed by a very steep right turn, assumed to be initiated in order to line up with the extended centerline. This maneuver was continued into a partial roll and subsequent

spiral into the ground. No transmissions were received from the pilot to indicate any sort of malfunction or disorientation. Pilot and TO were killed.

Pilot elected to make a low pass over airfield after completing his assigned mission, for no other reason than enjoyment for himself and spectators. According to witnesses, the pilot exceeded safe operational limits as specified in TM 55-1510-204-10/5 by banking the aircraft beyond 60° with external wing stores installed. Supervisory error is a contributing factor because the commander's oral directive—no low passes to be performed for any reason—did not reach all unit aviators.

ACCIDENT NO. 6—Pilot started aircraft and allowed temperatures to rise to normal. He then moved aircraft to runup area and performed normal runup, including cycling the propellers three times from low to high pitch. After approximately 20 minutes, pilot called for airport advisory and was given runway, winds, altimeter setting, and temperature. The runway surface condition was not included in the advisory. Pilot then taxied down runway 19 to avail himself of winds which favored runway 01. After he had taxied approximately 1,870 feet and attained a speed of 25 to 30 knots, he initiated the reverse check. At this time the No. 2 propeller failed to reverse. As rpm increased in both engines with No. 1 propeller in reverse and No. 2 at or near low pitch, aircraft began to turn to left. Pilot recognized the situation and began corrective action to realign aircraft on runway, applying right brake and rudder and moving

engine condition levers from reverse to ground idle position. This action had little effect on aircraft's ground track and pilot applied power to No. 1 engine in an attempt to check this movement, while continuing to apply right brake and rudder. At this point, aircraft had turned approximately 50° to 60° to left and pilot attempted to reverse propellers again. Realizing he had little or no control of aircraft at this point pilot began to prepare for impact. Both propellers were placed in feather position and aircraft departed runway 430 feet after initial application of reverse thrust and right main landing gear braking. Aircraft passed through an area of loose snow, crossed parallel access road, and skidded into large hard-packed snowbank.

The speed at which the aircraft was taxied before application of reverse thrust was excessive. The reason for the excessive speed was attributed to poor judgment on the part of the pilot and the lack of adequate ground reference points due to the snow-covered terrain. The application of differential power and the subsequent attempt to reverse only aggravated the already deteriorating situation.

A break in a wire leading to the No. 2 propeller reversing switch located on the No. 2 engine condition lever rendered the system inoperative. It is suspected that extreme cold temperatures and continued flexing of the wire during previous normal operations caused it to break.

ACCIDENT NO. 7—Pilot and TO were on a SLAR mission. After climbout and during most



ACCIDENT NO. 6

of the flight there was considerable fluctuation on No. 2 engine instruments. When air conditioning system was activated smoke filled cockpit. There was also a malfunction in the SLAR system which caused the mission to be terminated sooner than planned. During approach for landing in IMC, master caution light and various annunciator panel lights illuminated. Failure indicator flags also displayed on primary flight instruments. Indications were interpreted as failure of No. 1 and No. 2 inverters. Pilot switched to backup mode, which did not correct

the situation. He then attempted to fly partial panel and notified GCA he had lost his flight instruments. GCA responded that the rest of the approach would be a no-gyro GCA. Pilot attempted to fly partial panel for approximately 1 minute until he could no longer control aircraft. Pilot and TO successfully ejected.

This pilot became disoriented because of loss of flight instruments. There were 12 possible areas of materiel failure or malfunction, any one of which could have disabled the aircraft.

SELECTED INCIDENT BRIEFS

■ Left main tire blew approximately 200 feet after touchdown. Aircraft veered left and came to rest on left side of runway. Skid marks indicate left wheel was locked on touchdown.

■ Pilot was attempting to taxi aircraft out of revetment when left wing tip struck revetment wall.

■ Pilot landed too far down runway and applied excessive braking. Both main tires stopped turning and skidded on runway. Right main tire blew out just before aircraft stopped.

■ No. 1 engine seized during takeoff roll and fire ensued. Rollout was completed without further incident. Engine fire warning light did not illuminate. Pilot noted fire, used both fire bottles, and secured engine.

■ Aircraft was taxiing to runway from parking area when right wing tip struck windscreen of parked aircraft.

■ UHF antenna was found broken off aircraft during postflight inspection. Pilot suspected he may have struck a powerline as he was taking photographs. UHF antenna was found at approximate location of suspected wire strike.

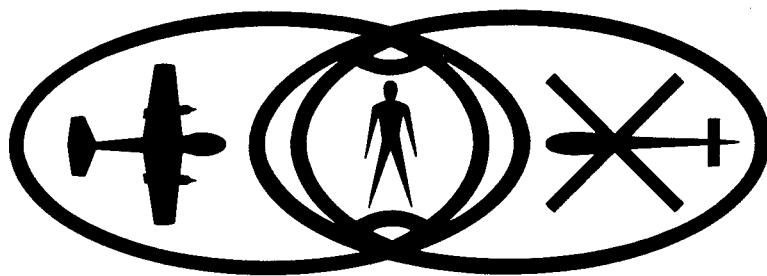
■ Propeller struck top of palm tree during low-level photo run.

■ Pilot began right turn, heard loud noise, and felt yaw to right. TO noted right engine cowling had blown loose. Pilot returned to airfield and landed.

■ Pilot maintained climbing right turn after takeoff and was passing through 3,000 feet indicated when aircraft surged and became left wing heavy. Pilot trimmed aircraft, continued climb, and had TO check to see if right drop tank was still attached. TO reported that it had left aircraft. Pilot elected to continue with the mission as 1 hour flying time would be required to empty left drop tank so landing could be safely made. Drop tank was improperly installed.

■ During cruise flight, pilot noticed that right cowl door on No. 1 engine was missing. About 1 minute later he heard something hit aircraft. This was later determined to be right cowl door from No. 2 engine. Pilot returned to airfield and landed.

■ Right hatch blew open approximately 5 minutes after takeoff. Maintenance determined that hatch lock did not malfunction. Although pilot checked hatch, he failed to detect that it was not properly secured.



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